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THE DYNEVAL (DYNAMIC ECONOMIC VALUES) MODEL
ECONOMIC RECOVERY ANALYSES

AC00C104 - Volume III

prepared for:

UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY

prepared by:

Decision-Science Applications, Inc.
1500 Wilson Boulevard, Suite 810
Arlington, Virginia 22209

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FIGURES

1.0 INTRODUCTION

This report describes the results of studies conducted by DSA using the economic model DYNEVAL to analyze the problems of economic recovery following a large-scale nuclear attack. To illustrate its applicability to other economic scenarios, the model was also used to estimate the adaptibility of the Soviet economy to increased military expenditures. Finally, to provide a basis for assessing the significance of the economic projections provided by the model, a number of studies are included to illustrate the sensitivity of model results to various types of assumptions.

To avoid giving an incorrect impression, it is important to interpret the results of this study within the context of the broader problems of survival and recovery in a post-attack environment. Previous studies have shown that it is useful to divide the process into three major phases: (1) survival, (2) reconstitution, and (3) recovery. In any of these phases it is possible--and perhaps even likely--that social and political order will collapse. If it does--or if the society becomes so disorganized that it is unable to restore an effective monetary system--the process of recovery could be delayed for an unpredictable and potentially very long time.

Even if social order is maintained and the society is able to restore an operating economic system, the process of economic recovery will inevitably take a substantial amount of time. This analysis is concerned with providing an estimate of the speed with which the economic recovery phase could theoretically take place, assuming that the society is able to function reasonably effectively throughout the three-stage process.

Previous DSA studies have given extensive attention to the problems of survival from blast, fallout, disease, starvation, and a variety of usually neglected effects in the immediate

post-attack (1 to 60 days) and the trans-attack (60-120 days) periods. Following this survival phase, one can expect a substantial period of economic readjustment--the reconstitution phase. During this period, it will be necessary to identify surviving resources and to organize a recovery program. This process could be very complex because most surviving industrial facilities will be without both their normal suppliers and their normal customers. Major mismatches will have to be resolved; i.e., it is not difficult to visualize a situation in which, for example, the surviving facilities in a given geographic area include one plant which produces tractor bodies and another which produces automobile engines. Once new suppliers of the necessary raw materials have been identified, production processes will have to be modified to resolve such mismatches.

It is only after this essential reconstitution phase--normally projected to last some 12 to 18 months--that real economic recovery could begin. This study is concerned with the problems of economic recovery following the reconstitution phase. Probably the most important single economic factor limiting such economic recovery is the loss of industrial facilities that are required in the rebuilding process. The process of recovery necessitates an orderly sequence of reconstructing destroyed facilities, and then using these facilities to rebuild other segments of the economy. The economic analysis in this study is concerned primarily with the extent to which limitations in surviving capital resources and labor would impose fundamental limits on the rate of economic recovery.

2.0 TARGETING SCENARIOS

Three different industrial targeting scenarios were examined. One involves a targeting philosophy which suggests that "across the board" destruction (i.e., comparable partial bottlenecks in all sectors of an economy) should be the attack objective. In this analysis, such a philosophy was simulated by assuming the destruction of 52 percent of total Soviet capital inventory in each economic sector; throughout the text, this simulation is referred to as the "uniform damage" case.

The second targeting scenario involves the assignment of values to individual components of the Soviet industrial base. This case is roughly representative of the results which would be obtained (in terms of damage vectors) if targeting were optimized relative to a weighted average of annual manufacturing value added and the invested capital in each industrial facility. In this analysis, this scenario is referred to as the "normal target value" case.

Finally, the third targeting scenario, referred to as "critical sector" targeting, is representative of the targeting damage outcomes that might be produced if a value multiplier were designed for each economic sector to reflect the degree to which each such sector is important to the post-attack economy.

3.0 SENSITIVITY ANALYSES

3.1 LEVEL OF AGGREGATION

The model tends to be optimistic in projecting economic recovery trajectories, for two reasons: first, since it is an optimizing model, it implicitly assumes that policy makers will promptly make the decisions that are required to achieve good economic performance; and second, the model allows perfect freedom of substitution within a given economic sector. For example, within a "machine-building and metal-working" sector aggregation, the model could effectively substitute, e.g., construction cranes for railroad locomotives. The degree of optimism attributable to this kind of "substitution freedom" diminishes, of course, as sector disaggregation occurs. For example, if one creates two new economic sectors--one for construction machinery production and one for transportation equipment production--the substitution of cranes for locomotives can no longer occur within the model.

On the other hand, in the real economy a considerable degree of substitution is possible; for example, wood desks can be substituted for metal desks. Because DYNEVAL does not permit any substitution between sectors, it can become too pessimistic about the rate of recovery if it is used with a disaggregated economic representation that includes too many, very detailed sector definitions. The sensitivity of model results to the level of aggregation was examined by comparing the results of two different levels of aggregation--a 13-sector and a 30-sector representation of the Soviet economy.

3.2 CAPITAL GESTATION PERIODS

In the base case analyses, an average capital gestation period of one year was assumed. To determine the sensitivity of model results to this assumption, excursions were examined for average capital gestation periods of one-half year and two years.

3.3 DEMAND ELASTICITY

Demand elasticity is a measure of the way the value of any good or service tends to change as a function of the supply of that good or service. The more inelastic the demand, the more rapidly this value will tend to increase as the supply is reduced.

In the environment of post-attack economic recovery, the elasticity of demand has an important effect on willingness to invest for the future. If demand is assumed to be very inelastic, then--at high levels of deprivation--society should be very reluctant to make additional current sacrifices to improve their relative well-being in the future. Conversely, if demand is very elastic, society might be willing to make larger sacrifices in the early years in order to achieve more rapid recovery of the economy in toto.

Since demand elasticity at high levels of deprivation must be estimated judgmentally, it is important to know how sensitive model results are to this parameter. To explore this sensitivity, test runs were made covering a full reasonable range of overall elasticity--from 0.5 to 2.0. In addition, a test was made to determine the effects of different elasticities in different economic sectors. In this test, food and clothing were treated as relatively inelastic in comparison with other commodities.

3.4 THE BASE CASE

To provide a base case for comparison, 1972 Soviet input/output tables were used as the economic baseline. Thus, the economic demand (or utility function) within the model was calibrated to the 1972 Soviet economy, assuming an annual population growth of 1.6 percent and a growth in real GNP per capita of about 2 percent at that time.

Two different 13-sector base cases were used in the sensitivity analyses. For the purposes of the demand elasticity

and capital gestation excursions, surviving economic resources were judgmentally estimated based upon DSA's general experience with targeting studies. For the evaluation of sensitivity to levels of aggregation, another 13-sector base case was developed which could be quantitatively related both to specific targeting simulations and to a more detailed (30 sector) representation of the Soviet economy. This second 13-sector base case is identified as "base case mod".

In all of the cases representing nuclear attack scenarios, it has been assumed that 70% of the Soviet population survives. This variable is changeable, of course, at the discretion of the analyst.

3.5 DISPLAY OF RESULTS

The principal displays used throughout this report are curves showing differences resulting from changing assumptions about demand elasticity, capital gestation periods, surviving resource levels, etc. Unless otherwise indicated, these curves are plotted in billions of rubles, using the 1972 internal prices. Each graph normally also shows a value for the data base economy (i.e., the 1972 Soviet economy) and a curve representing the projected economic trajectory for an "undamaged" economy; that is, one wherein there is no initial reduction in resource levels.

Most of the curves we display are representations of *per capita* rates of total consumption, total investment, Gross National Product (GNP), and total production; and mid-year capital inventory levels. In some cases, in order to illustrate some of the detailed results provided in the model, subsections of these "total" per capita rates have been plotted. For example, in one instance we have shown an investment profile by sector.

It is important to remember that most displays in this report show per capita p·ojections, and that all displays equate "current" with 1972. (A separate DSA research effort involves updating summary measures of Soviet economic performance so that model projections will more accurately reflect current conditions.) To translate per capital curves into "absolute" curves, one must multiply particular per capita values by population (for each time period) expressed as a percentage of preattack population. To illustrate differences in plotting per capita and absolute value projections, Fig. 4-2 shows total production curves (30-sector representation) plotted both ways.

4.0 SENSITIVITY ANALYSIS RESULTS

4.1 LEVEL OF AGGREGATION

As suggested in Sec. 3.1 above, the level of optimism of the model (in terms of the capability of an economy to recover from some significant drawdown in resources) which is attributable to perfect freedom of substitution within economic sectors decreases as sector disaggregation occurs. To gain insights into the effect of changes in substitution flexibility associated with the level of aggregation, we made comparisons between base case mod (13 sector) and 30-sector base case runs.

To support this comparison process, we first made targeting runs to develop damage vectors which could be translated into surviving resources for the 30-sector aggregation. We then converted these surviving resource fractions into comparable fractions for the 13-sector aggregation. Thus, the differences in results should be attributable almost exclusively to differences in the level of aggregation.

Figure 4-1 plots GNP rates for the 30 sector base case (normal target values) and the corresponding 13 sector base case mod over the 10 year period following a nuclear counterattack directed at Soviet industry. The rate of total production over the same period of time is shown in the next figure (4-2). Note that there are differences in, e.g., the GNP and production trajectories, primarily attributable to the higher degree of substitution freedom permitted within the 13 sector representation. However, the differences are small enough that they are probably not significant for most investigations to be conducted by ACDA analysts using the model. Depending upon the level and detail of accuracy desired, the analyst would be well advised to weigh the additional costs--in CPU and print time--against his desire to reduce the substitution freedom within the model.

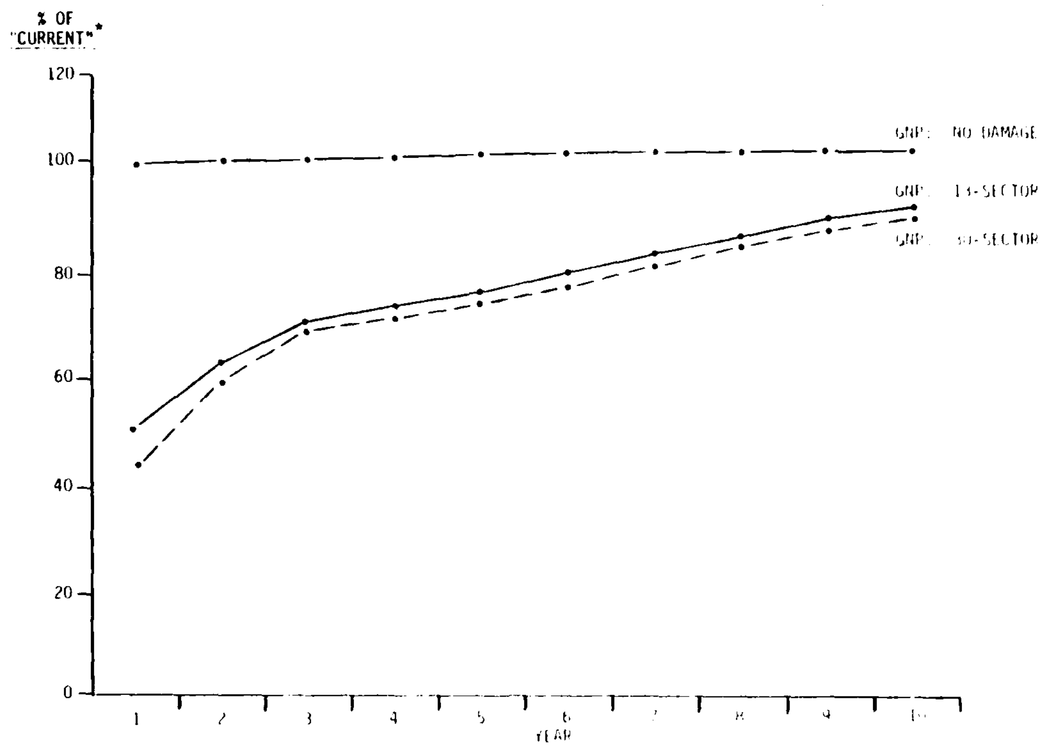

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Figure 4-1. GNP (Per Capita) Rates Compared: 13-Sector (Base Case Mod) and 30-Sector (Base Case) Aggregations--Soviet Economy

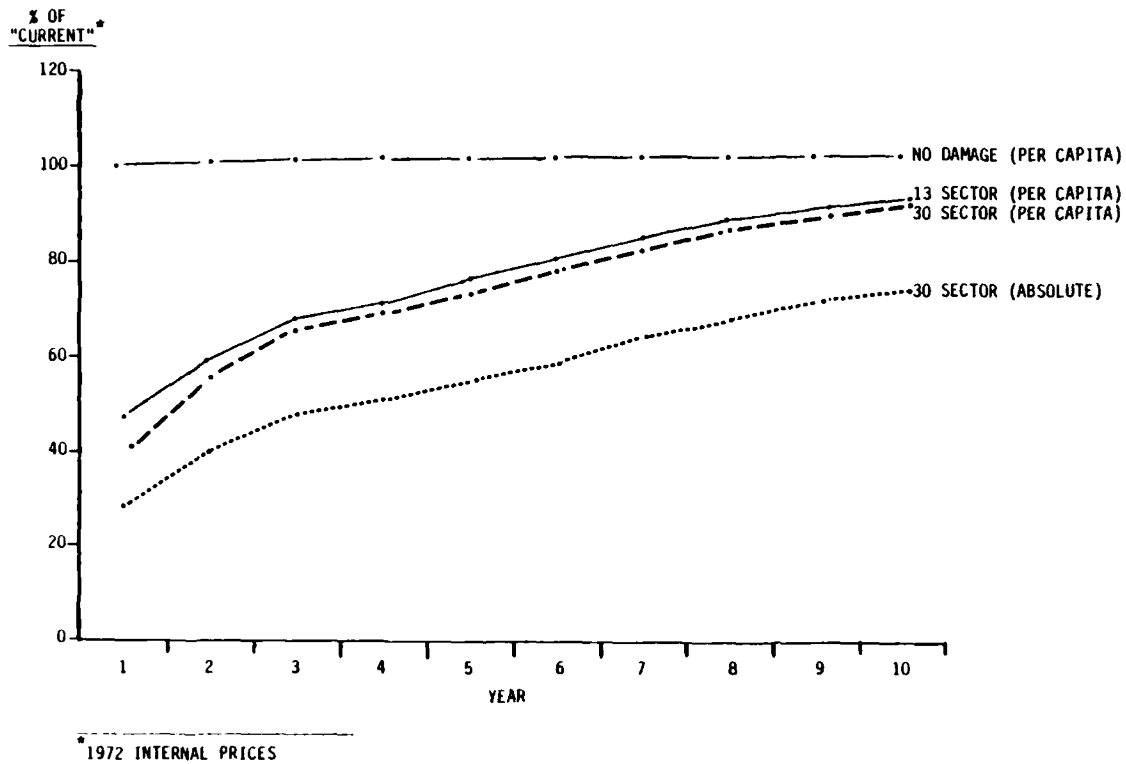

Figure 4-2. Total Production Rates Compared: 13 and 30 Sector Aggregations--Soviet Economy

4.2 AVERAGE CAPITAL GESTATION PERIOD

One expects the model to be sensitive to changes in physical parameters; e.g., surviving resource levels, different capital gestation periods, etc. If the model is not sensitive to such changes, it has limited utility for investigations of the sort envisioned by ACDA. Accordingly, we have examined the 13 sector base case results (using an average capital gestation period of one year) in comparison with similar sectoral representations in which the only variable changed was the capital gestation period. In one case, this period was changed to one-half year; in the other case, it was changed to two years. Figures 4-3 through 4-8 demonstrate some of the effects of these changes.

Figure 4-3 shows the different GNP trajectories resulting from changes in the capital gestation period. Note that there are significant differences in GNP trajectories over the first 10 years. As one would expect, there are even more noticeable differences in total investment rates (Figure 4-4) as well as in the curves showing accumulation of capital inventory (Fig. 4-5), while the differences in production rates (Fig.4-6) more closely correspond to the differences in GNP rates.

The rate of investment curve for the "no damage" case in Figure 4-4 reflects the fact that technological change is not currently simulated in the model. The gradually decreasing investment rate through about year four results from drawing down to zero the amount of investment normally associated principally with technological improvements. The differences in the investment patterns for the three capital gestation period cases are also very noticeable in this figure. For example, the investment rate in the half-year case peaks in year three, while the investment rate for the two-year case has not yet reached its peak in year ten.

Figures 4-7 and 4-8 show, respectively, investment profiles by economic sector for the one-half year and the two year average

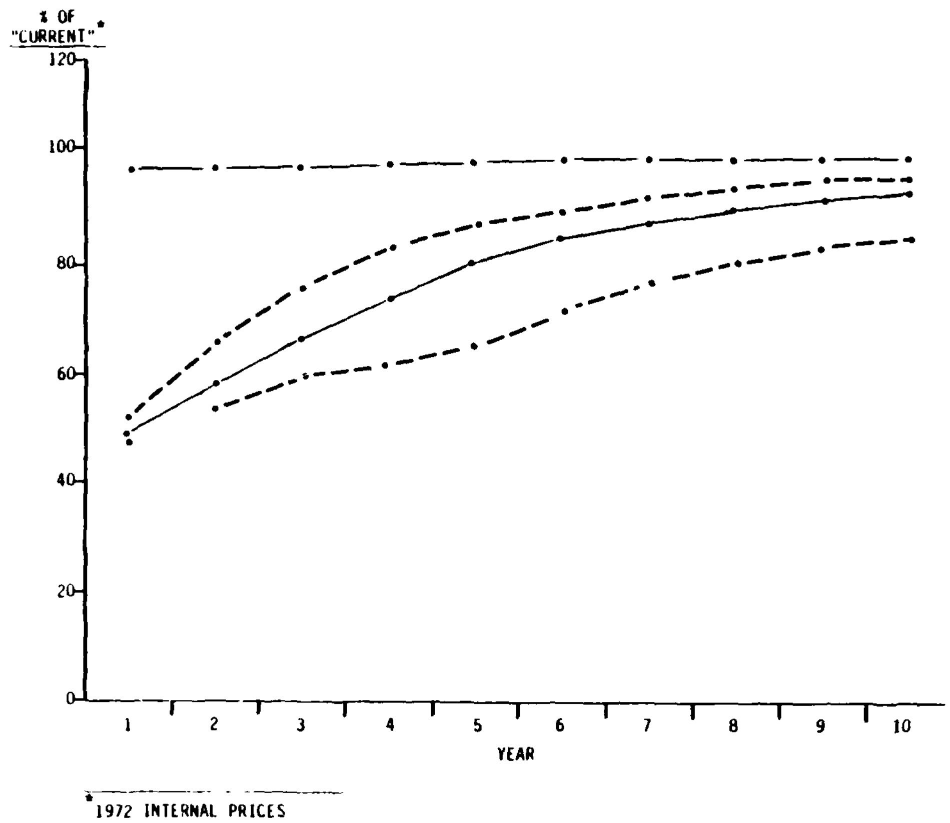

Figure 4-3. GNP Rates (Per Capita) for Different Assumptions About Average Capital Gestation Periods--Soviet Economy

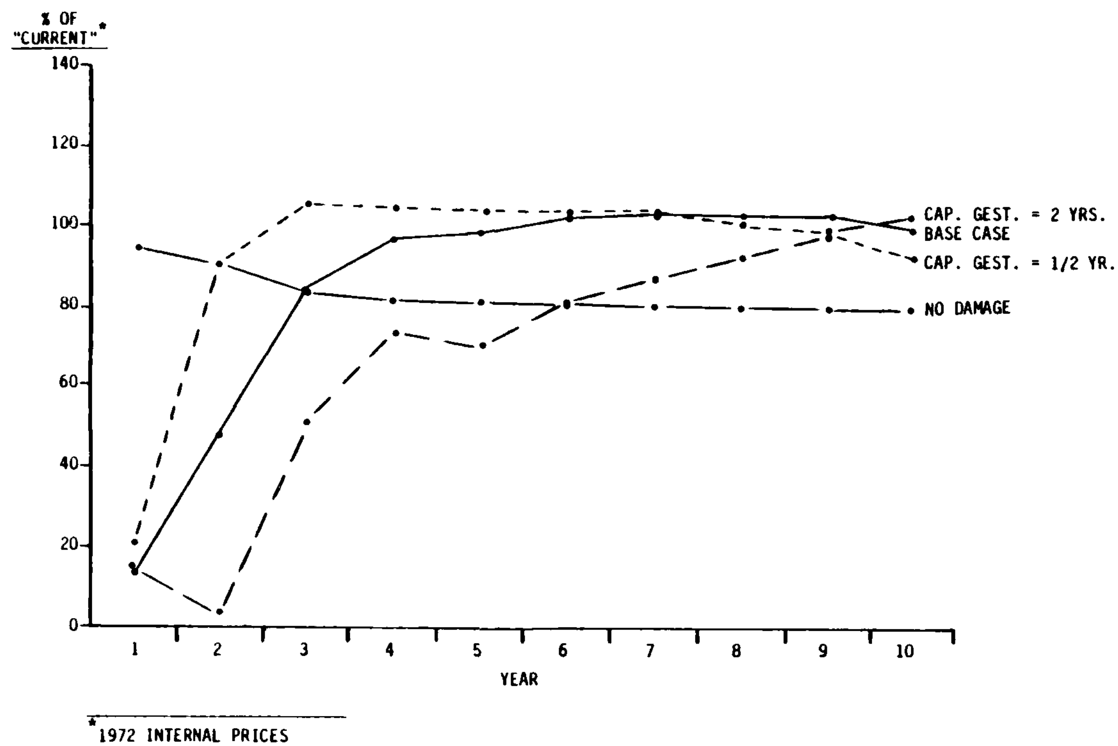

Figure 4-4. Total Investment Rates (Per Capita) for Different Assumptions About Average Capital Gestation Periods--Soviet Economy

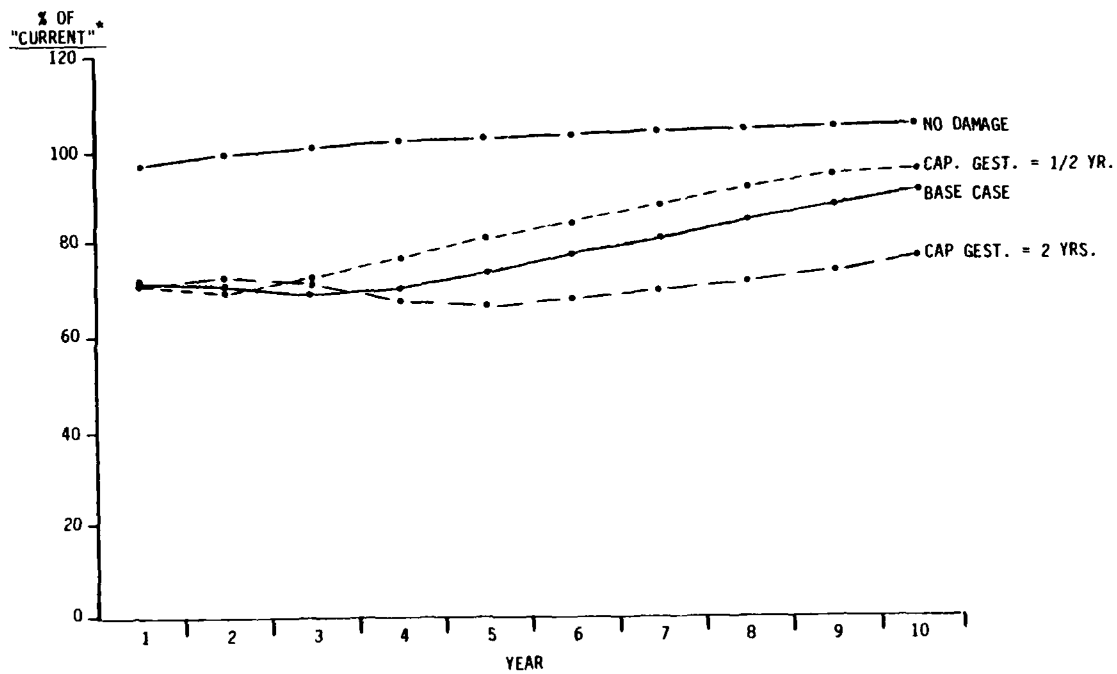

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Figure 4-5. Capital Inventory Buildups (Per Capita) for Different Assumptions About Average Capital Gestation Times--Soviet Economy

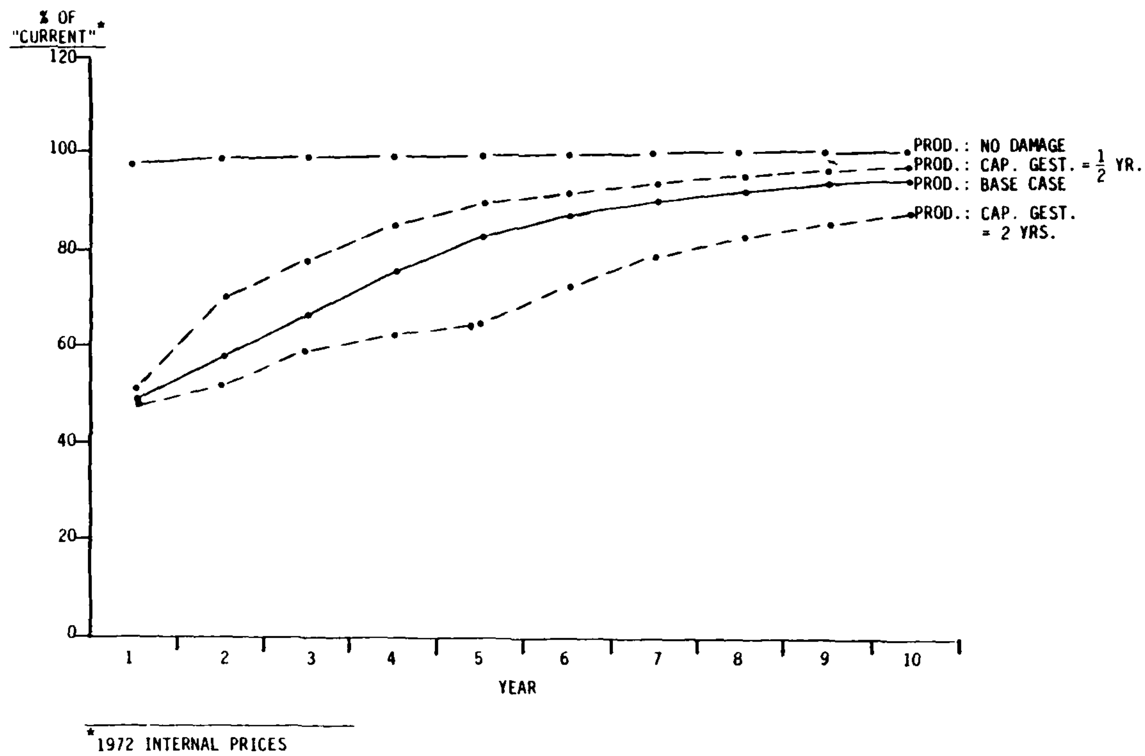

Figure 4-6. Per Capita Total Production for Different Assumptions About Average Capital Gestation Periods--Soviet Economy

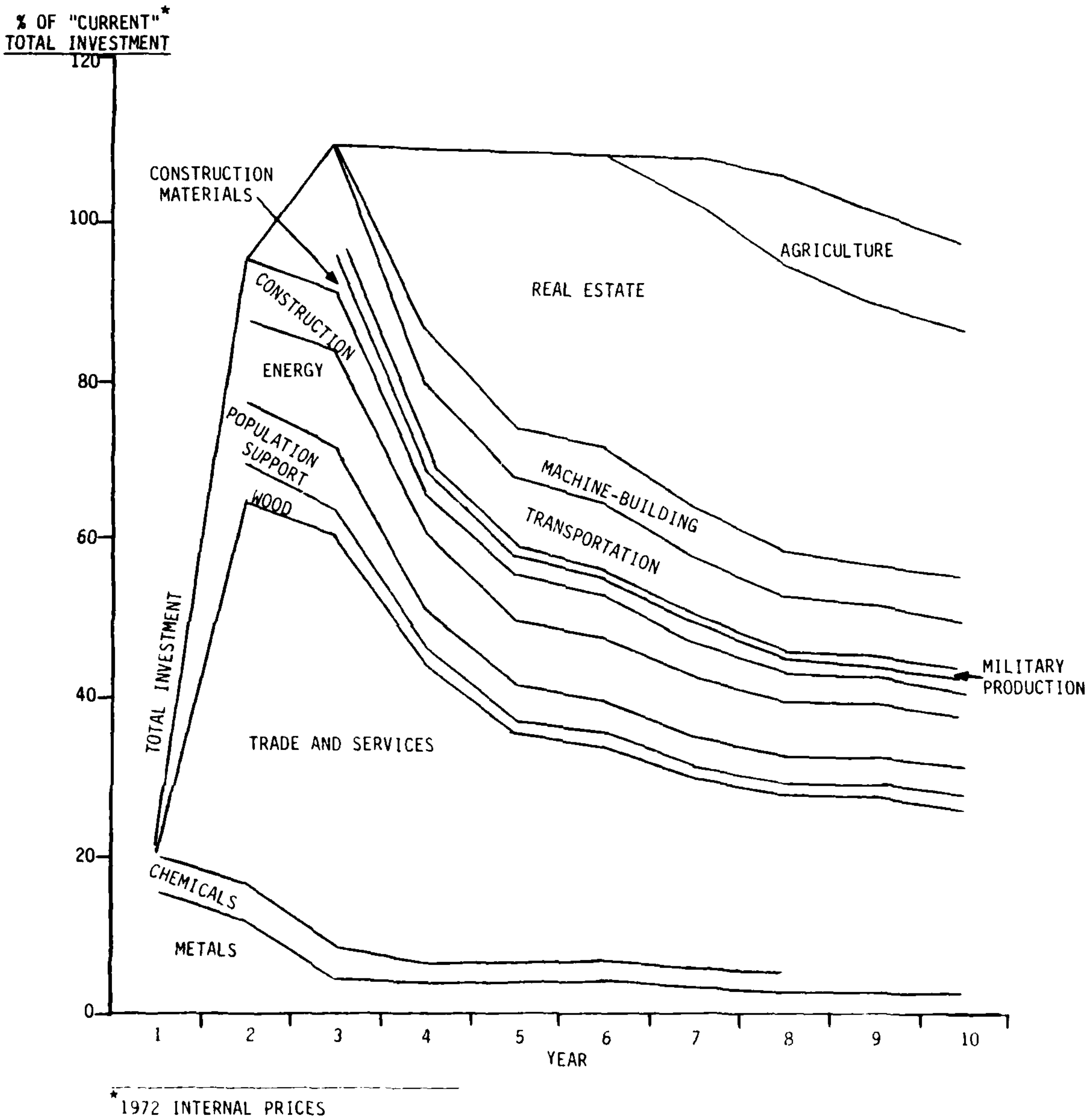

Figure 4-7. Investment Profile by Sector: Average Capital Gestation = ½ YR.--Soviet Economy

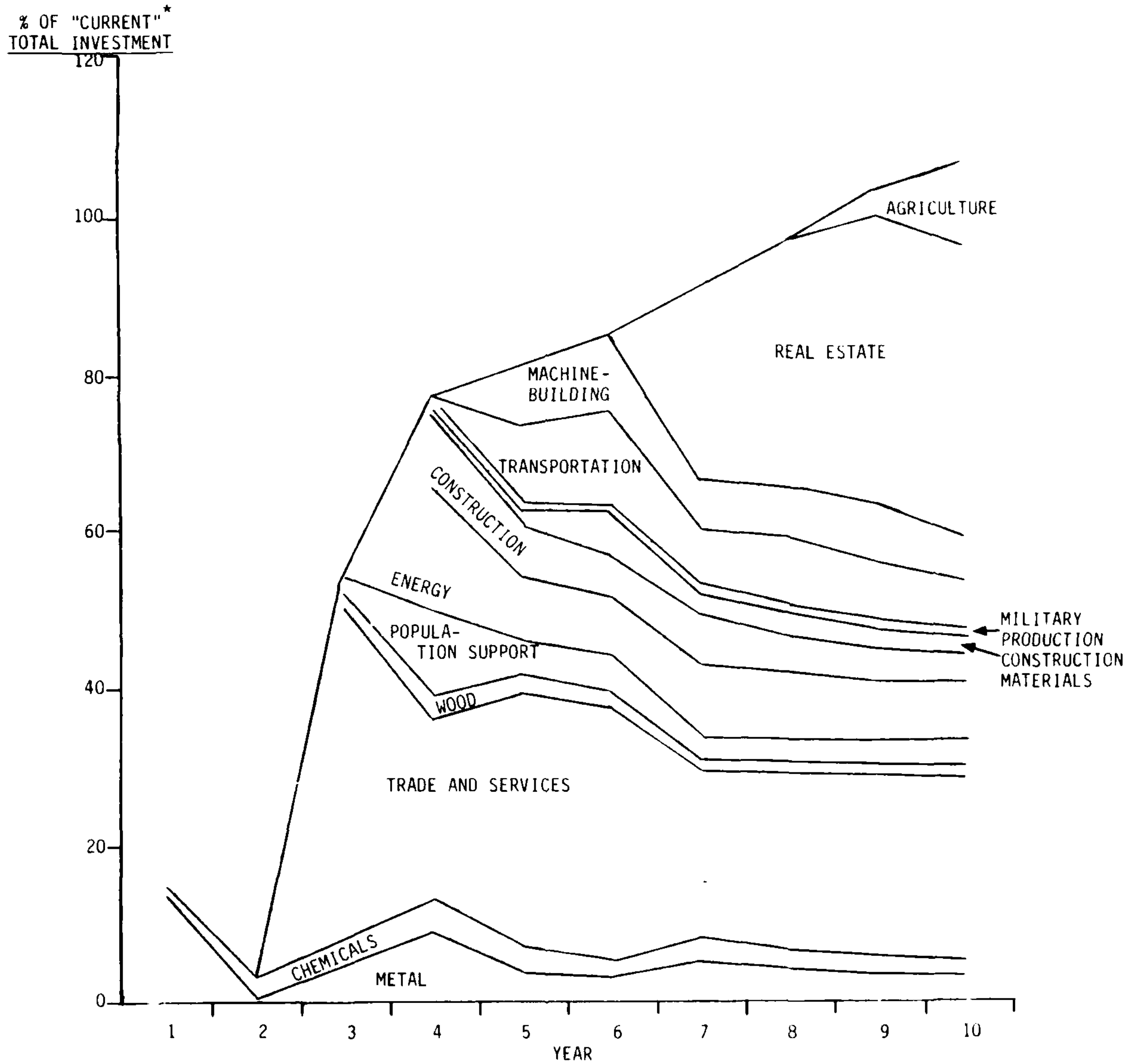

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Figure 4-8. Investment Profile by Sector: Average Capital Gestation = 2 YRS.--Soviet Economy

capital gestation period cases. Note that the differences in model results using these different assumptions is even more noticeable when viewed in this kind of detail. For example, the first sizeable investment in the real estate sector occurs in time period 4 in the half-year case but not until time period 7 in the two-year case.

The results of this examination lead us to conclude that the model is appropriately sensitive to changes in basic assumptions about average capital gestation periods. Further, from these comparisons it is apparent that the longer gestation times have an effect on results which is rather analogous to what might be expected if the decision process itself were delayed. Thus, the use of a gestation time that is somewhat longer than is viewed as realistic may provide a useful way of simulating a less prompt and less efficient decision-making process.

4.3 DEMAND ELASTICITY

In a post-attack economy, many resources are likely to be in extremely short supply. In such a situation, a scarce resource can become critically important, and its effective unit value to the economy can be many times what its value would be under normal circumstances. Within the model, this dependence of the value of a commodity on the supply of that commodity is specified in terms of an estimate of the demand elasticity. The less the elasticity, the more rapidly the marginal value of a commodity will rise as the supply is reduced.

Because the demand elasticities used within the model have to be estimated on a judgmental basis, it is important to know how sensitive the model results are to these parameters. If the model were overly sensitive to such judgmental assumptions, its utility for the kind of quantitative analyses to be conducted by ACDA could be too limited. Demand elasticity is a prime example of the kind of "judgment" assumption about which there could be considerable disagreement.

Typically, the overall elasticity of economic demand is estimated to be close to 1.0. This level of demand elasticity (which corresponds to the familiar logarithmic utility function) implies that a reduction of supply by a factor of two will result in a factor of two increase in the unit value of a commodity.

To explore the sensitivity of the model to different assumptions about demand elasticity, some extreme variations of elasticity were considered. Specifically, comparison excursions were completed using demand elasticities of 0.5, 1.0, and 2.0. An elasticity of 0.5 corresponds to a very elastic demand. Specifically, a reduction in supply by a factor of four is required to produce a factor of two increase in unit value. The elasticity of 2.0, in contrast, corresponds to a quite inelastic demand--one in which a decrease of a factor of two in supply will produce a factor of four increase in unit value.

Figure 4-9 shows the effect upon projected GNP rates of significant changes in the assumption about demand elasticity following a large-scale nuclear exchange. Note that, in the critical period--the first year or two following the exchange--there is virtually no difference in GNP trajectories. Plots of other summary measures of economic performance, not displayed here, produce similar results.

One can also make detailed assumptions about the elasticity of demand for individual consumption activities (e.g., by the military, by the federal government, by the local government, or by the "public" for specific economic sectors). For example, a good argument could be made for the case that public demand for energy (to provide heat) and for population support products (e.g., food and clothing) would be relatively inelastic in a post-war environment. To examine the implications for model results of such a situation, we ran an excursion in which the only demand elasticity variables that were changed--from 1.0 to

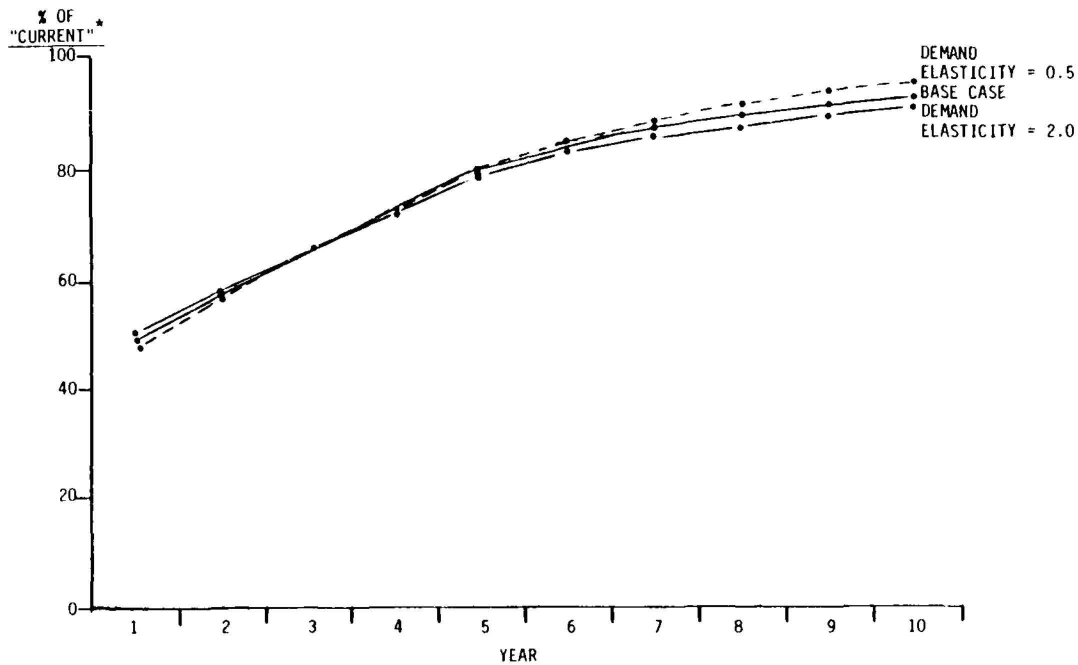

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Figure 4-9. GNP Trajectories (Per Capita) for Different Assumptions About Demand Elasticity--Soviet Economy

2.0-- were those for public consumption of energy and population support products. This excursion is referred to as the "selected demand elasticity=2.0" case. As is obvious from a cursory examination of the curves in Figure 4-9, the "selected demand elasticity=2.0" case would produce comparable results, were it also plotted on this graph.

In brief, the model is remarkably insensitive--during the critical immediate post-attack period--to uncertainties in the estimated elasticity of demand.

5.0 ALTERNATIVE TARGETING SCENARIOS

5.1 GENERAL

Any use of the economic model to assess the Soviet potential for economic recovery requires an initial estimate of the surviving fractions of Soviet capital inventory. In absolute terms, the model results are very dependent upon estimates of such surviving resources. However, in relative terms, model results can be extremely useful in identifying trends and approximate effects, even if one's assumptions about "base case" levels of surviving fractions are considerably off the mark. One of the potential pitfalls in the use of the model would be to use model results to represent a "real world" situation in a case where insufficient attention has been given to the projection of surviving resource levels.

The translation of damage vectors--resulting from simulated warhead laydowns against Soviet industrial targets--into precise levels of surviving Soviet resources was not within the scope of this contractual effort. However, in the process of satisfying the contractual provision for demonstrating the use of the model in three different targeting scenarios, we did exercise considerable care in translating damage vectors into surviving Soviet capital inventory levels. All three targeting scenarios used the 30-sector aggregation.

The base case run involved a simulated laydown of nominal 100 kt warheads against Soviet industrial targets, with individual target values based upon an average of manufacturing value added and estimated capital investment. This laydown resulted in the destruction of some 78 percent of total industrial data base value; and this 78 percent destruction level was translated into a 52 percent level of destruction of total Soviet capital inventory. To provide a "uniform damage" case with a matching level of total destruction, the capital resources in each of the 30 economic sectors were assumed to survive at the 48 percent level. To provide a "critical sector" case, value

multipliers were applied to the base case targeting values in order to develop new target values which would more accurately reflect the importance of the various economic sectors to the overall operation of the Soviet economy. The magnitude of these target value multipliers was estimated on the basis of the shadow value for surviving capital in each sector, as calculated by the economic model for the base case laydown. The laydown simulation was then reaccomplished for the same number and types of weapons, using these new target values.

Table 5-1 shows the surviving resource levels by economic sector for each of the three targeting scenarios. One should bear in mind that these surviving resource levels are not intended to represent the definitive answers to the question of precisely what levels of damage could be inflicted upon Soviet capital resources in the event of an all-out attack on Soviet industry. On the other hand, neither should these estimates--other than the uniform damage case--be regarded as unreasonable representations of levels of destruction, since they are rather closely correlated with other results we have obtained in rather extensive investigations of the industrial targeting problem.

The reason that the uniform damage case results cannot be considered reasonable, of course, is that such uniform damage vectors are simply not attainable. However, the simulation of economic performance for such a case is useful in this analysis because it illustrates the variation of economic results that is attainable as a function of targeting philosophy.

5.2 GNP COMPARISONS

Figure 5-1 illustrates graphically--in terms of the summarizing GNP measurement--the differences in the Soviet potential for economic recovery (in relative--and perhaps very nearly in absolute--terms) under these three alternative industrial targeting philosophies. Note, for example, that the

TABLE 5-1

SURVIVING RESOURCES (FRACTIONS)

	Uniform Damage	Normal Target Value	Critical Sector
Ores and Metals	.480	.122	.042
Coke and Refractory Materials	.480	.122	.042
Industrial Metal Products	.480	.122	.042
Coal and Peat	.480	.733	.903
Crude Oil Extraction	.480	.950	.950
Oil Refining	.480	.185	.151
Natural Gas	.480	.463	.562
Electric Power	.480	.392	.464
Energy M&E	.480	.167	.160
Electrotechnical M&E	.480	.267	.303
Machine Tool M&E	.480	.267	.303
Precision Instruments	.480	.267	.303
Specialized M&E	.480	.267	.303
Construction Material M&E	.480	.194	.205
Transportation M&E	.480	.256	.270
Agricultural M&E	.480	.208	.231
Other M&E and Metalworking	.480	.267	.303
Chemicals	.480	.192	.129
Wood Products	.480	.087	.098
Construction Materials	.480	.520	.602
Textiles	.480	.287	.343
Food Products	.480	.390	.450
Construction	.480	.304	.403
Agriculture	.480	.996	.997
Transportation	.480	.315	.401
Trade and Services	.480	.606	.625
Military Production	.480	.236	.223
Other Production; Repair	.480	.088	.098
Communications	.480	.606	.625
Real Estate	.480	.606	.625
TOTAL	.480	.480	.569

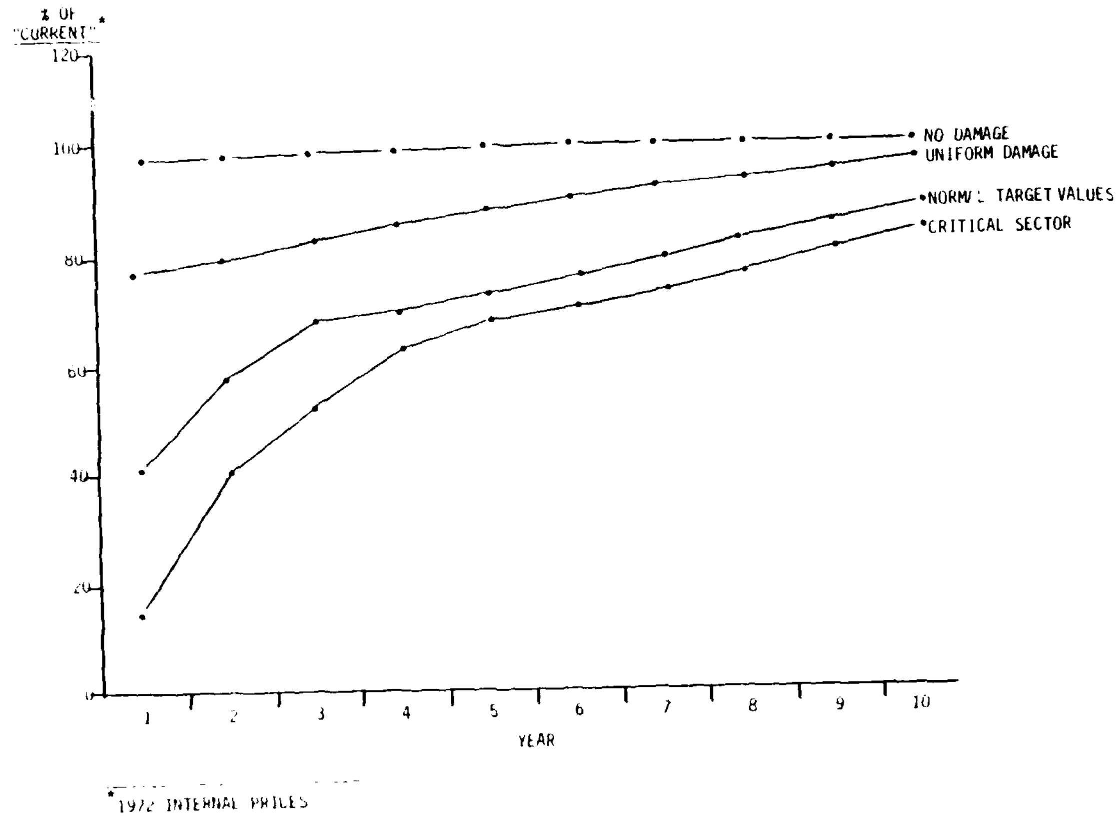


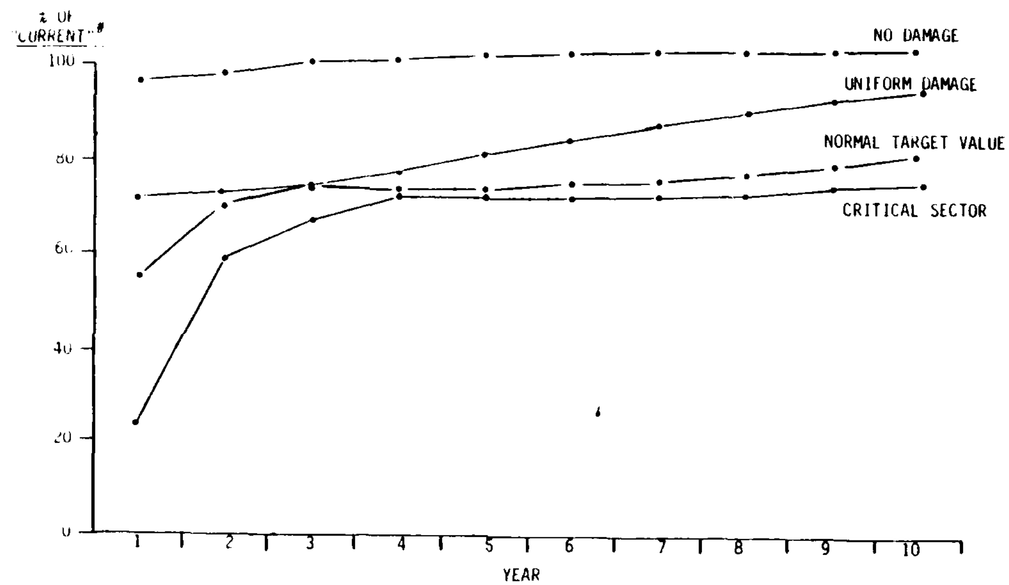
Figure 5-1. GNP Projections (Per Capita): Soviet Economy

Soviet recovery potential is greatest in the uniform damage case, and noticeably less in the base case. Such results seem intuitively reasonable because the base case targeting produces severe bottlenecks in certain key industries, whereas in the uniform damage case the use of extra shifts of workers in the surviving industrial facilities could go a long way toward alleviating the problem.

Note also that the critical sector case projects an even more severe recovery situation for the Soviet economy, especially in the critical early post-attack period. This is not surprising, since this critical sector targeting is further removed from the uniform damage case. In addition to considering the ruble values of production facilities, it also recognizes the fact that--on a ruble-for-ruble basis--some sectors of a highly industrialized economy are more important to the overall operation of that economy than are other sectors.

Recalling the caveat about the difficulties involved in translating target damage outcomes into surviving capital resources--as well as the optimizing tendency of the model--there clearly is substantial uncertainty associated with the absolute GNP ruble values displayed in Figure 5-1. However, the magnitude of changes resulting from the different targeting philosophies is sufficiently large that the trends seem very clear--In the critical, immediate post-attack period, when the viability of the Soviet economy would be most severely tested, the "critical sector" targeting philosophy would cause the Soviets significantly greater problems than would either of the other two philosophies.

Figure 5-2 demonstrates the effect of the alternative targeting strategies upon levels of goods available for public consumption during the first ten-year period following an attack. Conclusions about the "quality of life" in the immediate post-attack period are obvious.



*AS OPPOSED TO GOVERNMENT (MILITARY, FEDERAL AND LOCAL) CONSUMPTION

#1972 INTERNAL PRICES

Figure 5-2. Per Capita Public Consumption*--Soviet Economy

6.0 CHANGES IN SOVIET MILITARY EXPENDITURE LEVELS

6.1 SCENARIOS EXAMINED

We completed a brief preliminary examination of the effect on the Soviet economy of decisions to increase military expenditure levels by approximately 5 and 10 percent. These levels were specified by the ACDA COR. The results of this investigation, which were provided to the ACDA COR when they were completed, are summarized below.

6.2 RESULTS

Table 6-1 summarizes the effects--in terms of model results--on the Soviet economy's projected long-term equilibrium state resulting from decisions to increase military expenditure levels by approximately 5 and 10 percent. Note that the actual changes which resulted were 5.3 and 10.5 percent. The increase in production, of course, results from increases in both capital investment and labor resources. The increased production level in turn permits a sufficient increase in consumables to account for approximately 47 percent of the increased military consumption. The remaining 53 percent comes primarily from approximately proportionate decreases in goods or services which would otherwise be available for consumption by the federal and local governments and by the public.

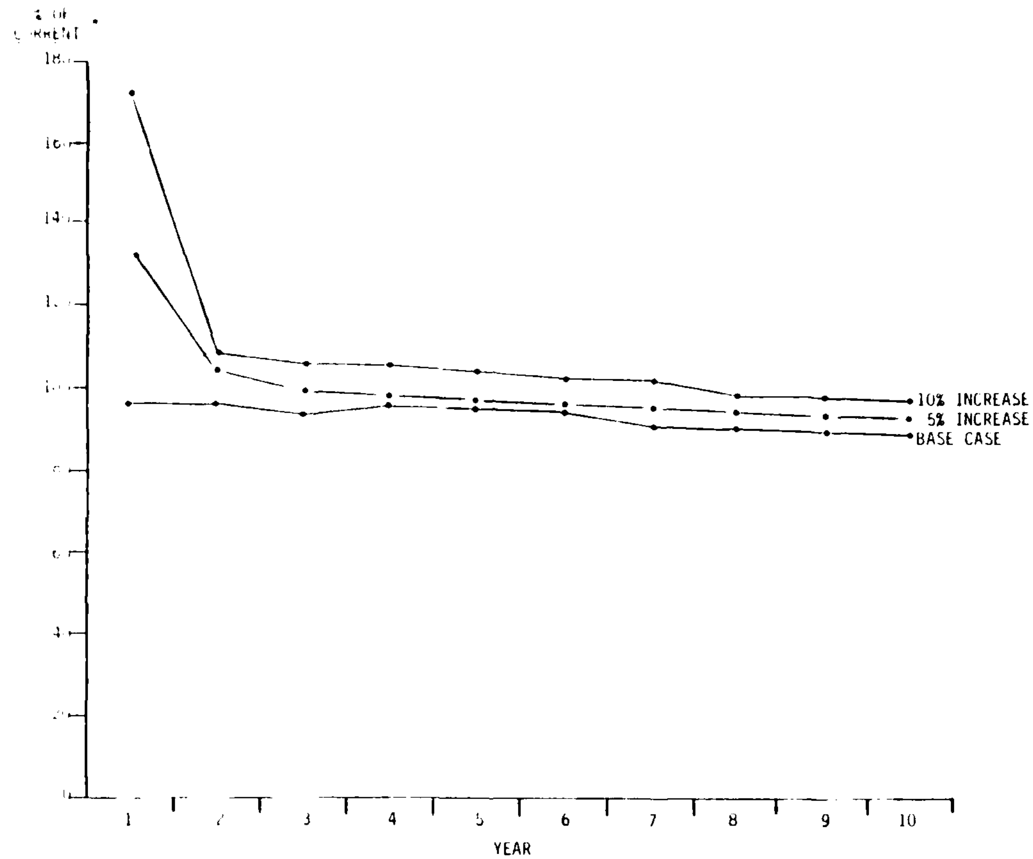
Figure 6-1 shows the investment profile changes for the military industry resulting from decisions to increase military expenditure levels. As one would expect, the most efficient means of building up military production is to make sizable increases in investment during the first year following the implementing decision. It is important to recognize that the 5 or 10 percent increase in projected military expenditures considered here does not correspond directly to a 5 or 10 percent increase in military capability. Although these increases would provide for a rapid 5 or 10 percent increase in military personnel, and an immediate 5 or 10 percent increase in the rate of purchases of military equipment, they would not provide a

TABLE 6-1

EQUILIBRIUM VALUES: SOVIET ECONOMY
(Million Rubles*)

	BASE CASE	CHANGE IN MILITARY EXPENDITURES 5% INCREASE		10% INCREASE	
			% CHANGE		% CHANGE
GNP	625,140	627,950	+ .4%	630,710	+ .9%
TOTAL PRODUCTION	1,111,000	1,115,000	+ .4%	1,118,700	+ .7%
TOTAL CONSUMPTION	554,860	557,530	+ .5%	560,210	+ 1.0%
TOTAL INVESTMENT	70,272	70,415	+ .2%	70,496	+ .3%
TOTAL CAPITAL INVENTORY	1,117,200	1,118,500	+ .1%	1,119,200	+ .2%
CONSUMPTION BY:					
Military	107,635	113,348	+5.3%	118,987	+10.5%
Federal Government	85,052	84,500	- .6%	83,953	- 1.3%
Local Government	79,311	78,797	- .6%	78,288	- 1.3%
Populace	299,889	297,973	- .6%	296,078	- 1.3%
EXPORTS (UNDIF.)	17,027	17,088		17,095	
MILITARY:					
Investment In:	753	786	+4.4%	818	+ 8.6%
Production	38,141	39,803	+4.4%	41,435	+ 8.6%
Capital Inventory	7,716	8,055	+4.4%	8,387	+ 8.7%
COST OF LABOR	1,014	1,021	+ .7%	1,027	+ 1.3%
LEISURE	344,718	342,396	- .7%	340,252	= 1.3%
INCREASE IN MILITARY CONSUMPTION COMES FROM:					
Total Increase in Consumption		2,670		5,350	
Federal Government Decrease in Consumption		552		1,099	
Local Government Decrease in Consumption		514		1,023	
Populace Decrease in Consumption		1,916		3,811	
Change in Exports		61		68	
TOTAL		5,713		11,351	

* 1972 Internal Prices



*1972 INTERNAL PRICES

Figure 6-1. Per Capita Investment Profiles: Military Equipment and Materiel Production as a Function of Increased Military Expenditures--Soviet Economy

correspondingly rapid increase in the inventory of military equipment. A rapid change in this inventory would require a temporary surge in military production which would be far larger and more sustained than is shown in Figure 6-1.

The economic model could, of course, be used to simulate such an assumption, but changes would have to be made in the representation of "military consumption" to reflect the increased importance of the accumulated inventory of military equipment.

A definitive analysis of the effect upon the Soviet economy of various levels of military expenditures is beyond the scope of this contractual effort. However, the model is clearly sensitive enough to such changes that it can provide insights into the kinds of pressures acting upon the Soviet leadership--pressures tending to force perhaps significant changes in policy decisions affecting both the future state of the Soviet economy and U.S.-Soviet relations within the context of SALT negotiations.

7.0 U.S. VERSUS SOVIET ECONOMIC RECOVERY POTENTIAL

A detailed comparison of the relative recovery capabilities of the U.S. and Soviet economies would, of course, be desirable. However, several factors combine to make such a comparison difficult under the best of circumstances, and impractical within the scope of this contractual effort.

First, the significantly different nature of the nuclear arsenals possessed by the two nations requires a number of important scenario-dependent assumptions about warhead types, yields and numbers to be assigned to the industrial attack mission.

Second, the basic structures of the two economies are sufficiently different to warrant separate investigations of weaknesses--or "chokepoints"--for the two systems. While the industrial targeting work we have done under other contractual efforts in examining weaknesses in the Soviet economy is adequate for simulating laydowns against Soviet industry, we have not had occasion to complete a similar examination of the U.S. economy.

Finally--and most significantly--there currently exists no usable U.S. industrial target data base (at least, outside the Soviet Union). Thus, one simply cannot simulate a warhead laydown against U.S. industry comparable to the kinds of simulations we are able to run against Soviet industry.

The best we could do to provide a rough comparison was to simulate a laydown against the Soviet Union and translate the resulting damage vectors into fractional surviving capital resources by economic sector, using a 30-sector representation of the Soviet economy. Then we applied these same surviving fractions to a 30-sector representation of the U.S. economy. Figure 7-1 shows the GNP recovery trajectories for both economies in this situation.

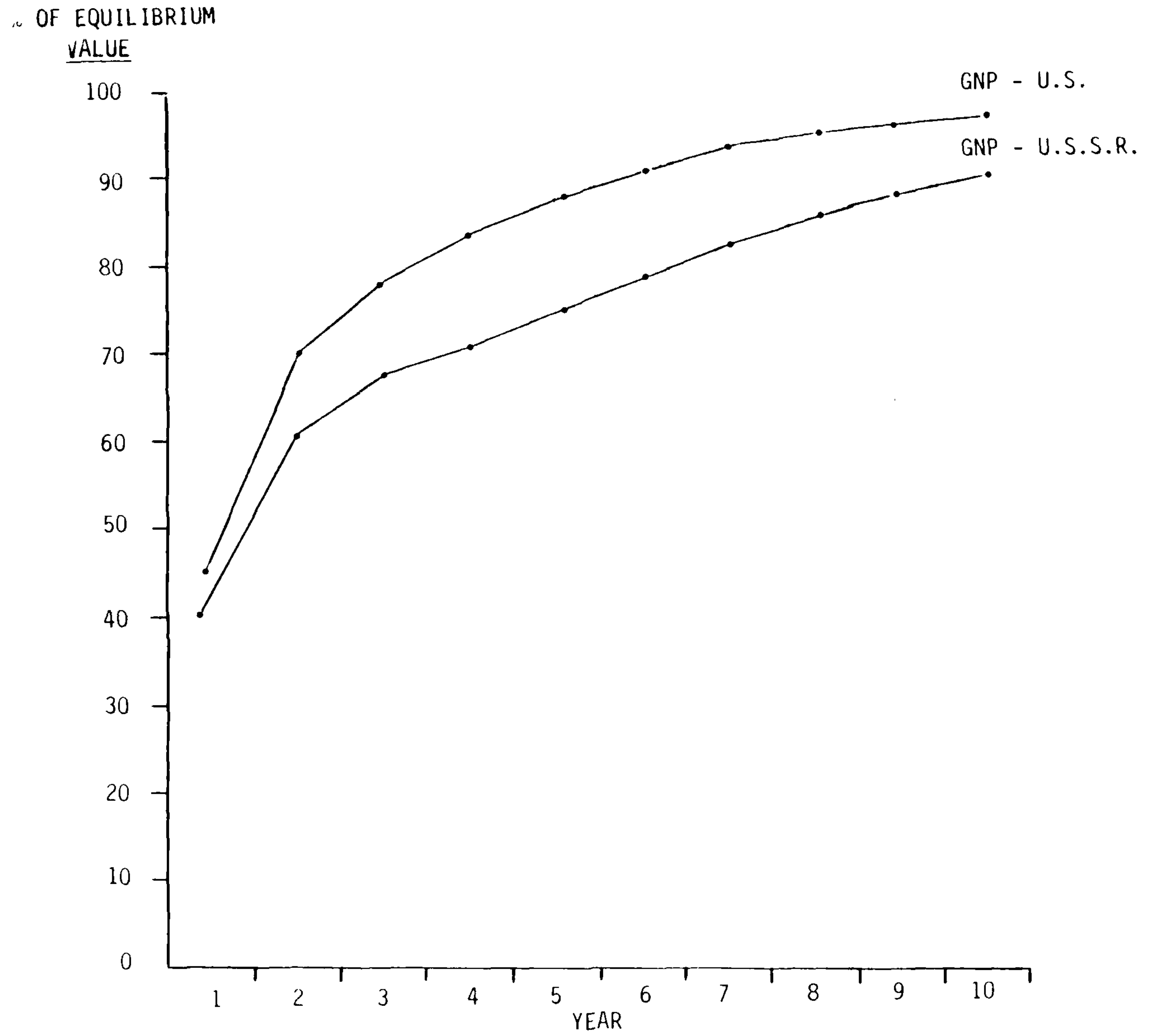


Figure 7-1. Per Capita GNP Recovery Trajectories for Equivalent Surviving Resource Fractions

The results of course cannot be interpreted as a direct characterization of the relative recovery capabilities of the two economies. Rather, they demonstrate--as one would expect--that this particular laydown simulation would have a more adverse effect on the Soviet than on the U.S. economy. Such a result is intuitive, given that the initial laydown was structured for an attack on Soviet industry. However, the results do suggest certain basic differences in the two economies, some of which are attributable to structural differences and some of which can be explained by differences in activity levels.

A satisfactory comparison of the relative recovery capabilities of the two economies must await both the development of a U.S. industrial target base comparable to the one being used for the Soviet Union, and a detailed quantitative examination of the principal weaknesses in the U.S. economy.

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